

Claims

1. A method for removing impurities from waste water by electroflotation, in which method the waste water to be cleaned is passed through an
5 electrolytic cell (28) provided with metal electrodes (1, 2), **characterized** in that electrolysis is performed between two electrodes (1, 2) of different electronegativities, such that the more electronegative electrode (1), which is non-wearing in a cleaning process, is used for producing hydrogen gas and hydroxyl ions from water, and that the less electronegative electrode (2),
10 which is an active, wearing electrode in a cleaning process, is used for producing metal ions in a solution to be cleaned, and that, in addition to this basic reaction, a desired oxidation-reduction reaction is initiated in the cell in a strictly controlled electric field for removing one or more designated impurities from cleaned water.

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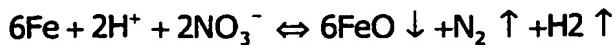
2. A method as set forth in claim 1 for removing nitrogen from waste water, **characterized** in that

- a) in electrolysis, hydrogen ions (H^+) are used for producing from ammonia (NH_3) ammonium ions (NH_4^+), which escape upon joining negative ions and upon coprecipitating with iron hydroxide precipitate;
- 20 b) the precipitate is allowed to rise along with hydrogen gas in the form of flock to the surface of clean water in a flock separation tower and/or a secondary settling tank; and
- c) in electrolysis, iron is oxidized and NH_4^+ nitrogen and/or nitrate
- 25 nitrogen (NO_3) is reduced as follows



and/or

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whereby the result is denitrification as nitrogen escapes from waste water in the form of nitrogen gas.

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3. Application of a method as set forth in claim 1 for cleaning landfill seepage or some other salt-containing waste water, such as contaminated sea water.

10 4. An application method as set forth in claim 3, **characterized** in that the seepage or other salt-containing waste water to be cleaned is conducted in a first stage through a first electrolytic cell, and in a second stage the water partially cleaned in the first stage is conducted through a second electrolytic cell.

15 5. A method as set forth in any of claims 1-4, **characterized** in that the less electronegative electrode is made of iron or aluminium.

20 6. An apparatus for removing impurities from waste water by electroflootation, said apparatus comprising a set of electrolytic cells, each cell thereof being provided with one or more metal electrodes (2) coupled with the positive pole of a power source and one or more metal electrodes (1) coupled with the negative pole of a power source, and an electrolysis space (5) between the electrodes, **characterized** in that the electrode (1) connected to the negative pole of a power source is made at least in its surface layer from a 25 more electronegative material than the electrode (2) connected to the positive pole, the more electronegative electrode (1) being non-wearing in a cleaning process and releasing only electrons received thereby into a solution to be cleaned, and the less electronegative electrode being an active, wearing electrode in a cleaning process and releasing metal ions into a 30 solution to be cleaned, the electrodes (1, 2) having such an electronegativity difference that a desired oxidation-reduction reaction is achieved.

7. An apparatus as set forth in claim 6, **characterized** in that the less electronegative electrode is made of iron or aluminium.
8. An apparatus as set forth in claim 7, **characterized** in that the electrodes 5 (1, 2) comprise coaxial pipes, the iron or aluminium pipe (2) being the outermost and readily replaceable.
9. An apparatus as set forth in claim 8, **characterized** in that the outer electrode pipe (2) terminates prior to a waste water inlet (6), while the inner 10 pipe (1) is provided with holes (4) and continues past the waste water inlet (6) by way of a valve (18) to a wash water pump (19).
10. An apparatus as set forth in claim 9, **characterized** in that the valve (18) has its opening and the wash water pump (19) has its actuation 15 controlled to proceed intermittently, while a valve (17) in an outlet duct (16) connected to the bottom end of the electrolysis space (5) is adapted to be opened for discharging precipitate and wash water from the electrolysis space (5).
- 20 11. An apparatus as set forth in any of claims 8-10, **characterized** in that the inner electrode pipe (1) is made of stainless steel and the iron- or aluminium-made outer electrode pipe (2) is covered with an insulating housing tube (3).
- 25 12. An apparatus as set forth in any of claims 8-11, **characterized** in that the electrode pipes (1, 2) are locked concentrically to each other by means of unscrewable end caps (10, 15), which enclose the inner electrode pipe (1) and inside which are retained the ends of the outer electrode pipe (2).